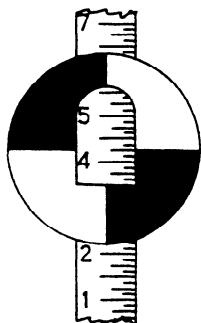
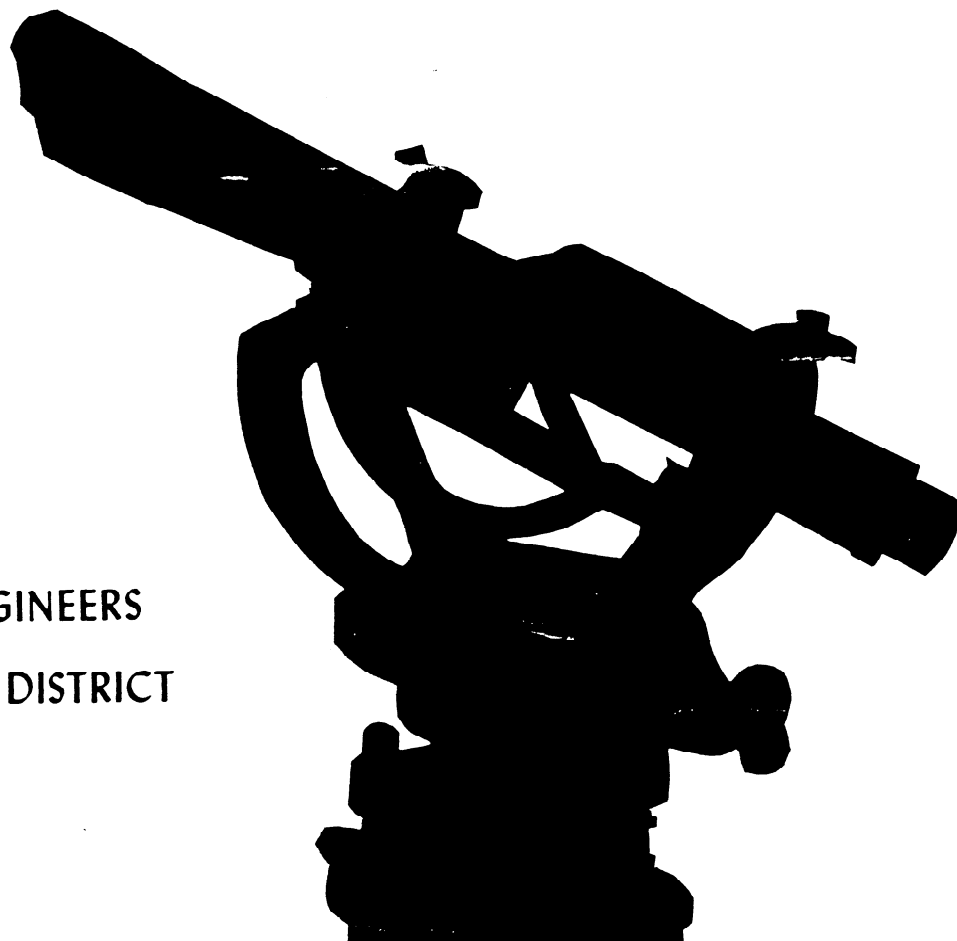


SURVEYING



MANUAL OF SAFE PRACTICES



U.S. ARMY
CORPS OF ENGINEERS
SACRAMENTO DISTRICT



BUILDING TOMORROW TODAY

DEPARTMENT OF THE ARMY
Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

SPK PAM 385-1-2

SPKSO

PAMPHLET
NUMBER 385-1-2

1 February 1979

Safety
MANUAL OF SAFE SURVEYING PRACTICES


FOREWORD

Pronouns, such as "he," "his," "him," are used for literary purposes and are meant in their generic sense (i.e., to include all humankind -- both female and male sexes). Obvious references to females and/or males solely, where appropriate, are specifically noted.

This manual provides a source of basic information which will aid in preventing injuries resulting from surveying operations. It was compiled from safety publications by Federal, State, and private agencies or firms.

The manual outlines responsibilities for safety and health and gives requirements for accident reporting. It has sections dealing with public relations, general safety precautions, and field work.

It is important to employ safe working practices in order to maintain the morale and work efficiency of all personnel. Accidental injuries can interrupt the progress of any job and cause the injured or sick needless pain and discomfort as well as substantial economic impact. No job is so important and no service so urgent that time cannot be taken to perform work in a safe manner.



DONALD M. O'SHEI
Colonel, CE
District Engineer

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CHAPTER I

PERSONAL SAFETY RESPONSIBILITIES

I. Individual Responsibilities -- Every employee is responsible for his own safety and the safety of his coworkers.

1. Safe Practices -- Each employee shall learn the personal and group accident prevention and injury treatments that are described herein and abide by them. Safety procedures and rules are not optional. Deviations are not allowed.

a. Knowledge and Location of Code -- Each employee shall have a practical working knowledge of this Manual of Safe Surveying Practices.

b. Violations of Safe Practices -- Each employee shall be alert to possible violations of safety policies. If violations are seen and the employee cannot correct them, he shall report this to his supervisor.

2. Operational Practices -- Each employee must routinely --

a. Report unsafe conditions or practices.

b. Promptly report all accidents and personal injuries to his supervisor.

c. Render or find aid, as required, for injured persons.

d. Be alert for hidden hazards.

e. Be alert for hazards created by changing conditions, either natural or manmade.

f. Avoid horseplay and practical joking.

g. Store and secure all equipment and supplies so they are not hazardous to persons or to vehicular operation.

h. Participate in housekeeping necessary for maintaining a safe and sanitary environment in vehicles and offices.

i. Set aside for repair or replacement, defective and unsafe tools and supplies and report such problems to your supervisor.

j. Carry gear such as plumb bobs, hand levels, and hatchets in sheaths instead of in pockets.

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k. Heed all specific practices listed in the topic "Operational Safety", below.

l. Avoid transporting or having or using on the job, hazardous or potentially hazard-causing things, such as fireworks, firearms and ammunition, intoxicating beverages and drugs.

m. Before acting, mentally check the safety of each action.

3. Safety Meetings --

a. Attend and participate in a tailgate meeting at least every five working days.

b. As required, attend other safety meetings and participate or cooperate fully in determining cause and prevention of accidents and injuries.

4. Personal Safety Equipment -- Each employee is furnished personal safety items which must be prudently and consistently used.

a. Regular Issue --

(1) Hard Hat -- An issued hard hat, with a chin strap, must be worn while exposed to moving traffic, construction equipment, falling or flying material, or similar hazards. Also wear it whenever working within the right of way of a traveled facility. (Knit or skullcap-type liners are also issued for cold-weather work.) Inspect the hard hat shell and cradle at least twice a year. If either becomes defective or deformed, replace.

(2) Safety Vest -- Orange or red vests or shirts must be worn while exposed to traffic hazards. ONLY orange or yellow vests or shirts are authorized for use as warning apparel while working on railroad right of way.

(3) Safety Glasses -- When exposed to hazards in (1), above, or to flying particles, hazardous substances, or injurious light rays and when using such tools as Ramsets and steel gads, wear safety glasses.

(4) Footwear -- Safety boots that provide protection and firm support for the foot and ankle will be utilized. Any other footwear will not be acceptable unless authorized by Chief, Survey Section.

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b. Special Issue --

(1) Goggles -- Wear "Mono-type", ventilated goggles when exposed to blowing dust, swirling sand, or other windblown or machine blown matter.

(2) Dust Respirators -- Use when you must breathe harmful dusts.

(3) Gloves -- Use when working in poison oak or brushing line through vegetation, such as buckthorn, locust, and briars. Also use when you or your supervisor feel gloves are necessary to protect against injuries such as puncture, laceration, and splinter wounds.

(4) Hearing Protectors -- Whenever operating gasoline chain saws or jackhammers, use hearing protection. Also use when working with or around equipment which creates noise levels above the limits established in Sec 32 of EM 385-1-1.

(5) Safety Belts and Life Lines -- When working on steep or slippery slopes, in trenches or subsurface facilities, or on elevated structures which do not have guard rails, use a safety belt and a life line.

(6) High-Visibility Apparel--When working in or close to traffic, wear --

(a) Nighttime Work -- a reflective belt or reflective devices and white coveralls.

(b) Wet Weather -- Yellow foul-weather gear.

Note: Avoid wearing rings, bracelets, necklaces, earrings, or other items that can hang up on objects, such as tools, brush, and door handles.

5. Physical Condition -- Each member of a survey team shall strive to report to work each day in a condition that will afford maximum agility, alertness, and capability. Each person should be --

a. Healthy -- If you are ill, do not report to work. If you become ill on the job, do not continue to work. Report to your supervisor and then get aid.

b. Rested and Nourished -- Each surveyor must report for work prepared to perform an alert, accident-free, full shift of work.

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For most individuals this dictates 7 to 8 hours of sleep and a nourishing breakfast.

c. Free From Influence of Drugs or Alcohol --

(1) Drugs -- Whenever a physician gives you a prescription, inquire if the drug might impair your safe functioning. If any impairment might result, ask the doctor what you can and cannot do while taking the medication, and notify your supervisor.

Do not report for work if you are under the influence of non-prescribed narcotics.

(2) Alcohol -- Do not report for work if you are under the influence of intoxicants.

6. Vehicular Operation -- To operate vehicles an employee must --

a. Possess a valid California Driver's License.

b. Attend Defensive Driving Training Program before operating any equipment. This training shall be repeated at least once every three years.

c. Possess a valid Federal Driver's Permit. In addition, all employees must heed the practices listed in the topic "Vehicles," below, and other practices that will help to prevent accident or injury.

II. Party Chief's Responsibilities -- Each first line supervisor is responsible for the work methods and safety practices on his party. The party chief is in the best position to see that all safety rules and procedures are followed and that all work is performed safely. Do not attempt to delegate this responsibility. The party chief, himself, must ensure the use of the one best SAFE method for each operation.

1. Manual of Safe Surveying Practices --

a. See that a copy of the Manual of Safe Surveying Practices is always available to members of your party.

b. Enforce all elements of the Manual and pertinent sections of EM 385-1-1.

2. Job Planning --

- a. Give safety first priority in planning each survey.
- b. As required for each job, develop additional safety practices.
- c. Request enough personnel for safe surveying.
- d. Insofar as possible, plan around hazards, especially traffic.

3. Personal Equipment -- See that each subordinate possesses, or has available, required personal safety equipment. You must see that employees use this equipment, as required.

4. Party Equipment -- See that equipment and supplies are safe to use and prepare a SPD Form 150, "Safety Inspection Checklist" for each piece of construction equipment.

5. Employee Orientation, Training, and Supervision --

a. New Employee --

(1) Make certain the employee has been briefed and trained by the Survey Branch and the Survey Supervisor, as required in Section III Survey Supervisor Responsibilities.

(2) Assign a storage area for the employee's personal safety equipment.

(3) Issue the employee a copy of EM 385-1-1 (General Safety Requirements Manual), the Manual of Safe Surveying Practices, and show him/her the lists of medical aid, the first aid kit, fire extinguishers, and where emergency flares (and/or reflectors) are stored.

(4) Show the employee where and how all equipment and supplies are safely stored.

(5) Adequately train the new employee in all required work tasks before allowing him/her to work.

(6) Administer and have the employee pass a road test if he/she is expected to operate a vehicle, even if only occasionally. For the test, have the employee drive the type of survey vehicle he/she will be driving in the field. Do not allow Youth Aids to drive.

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b. New Party Members -- Same as Items "E-1b through d",
above.

c. All Party Members --

(1) Keep them informed about District accident
prevention programs.

(2) Continually monitor employee safety performance and
attitudes. Immediately correct unsafe practices.

6. Performance Review -- During an employee's formal "Report of
Performance" and "Appraisal and Development" discussions, review
his/her safety performance and his/her safety attitudes.

7. Tailgate Meetings -- Conduct a tailgate safety meeting with
party members at least once every five working days. (See "Safety
Meetings" in the previous topic.)

8. Mishaps and Injuries --

a. Promptly give or obtain aid for an injured person.

b. At all times have at least one party member who has had
certified first aid training.

c. Thoroughly investigate all mishaps and injuries and take
corrective action.

d. See that all required reports are promptly prepared and
submitted (SPK PAM 385-1-1, Contractors Accident Reporting Guide for
Supervisory Employees).

e. When possible, discuss employee's injury with doctor and
provide doctor with a description of injured's duties (and alternate
duties available) so the doctor can determine when the employee will
be able to return to light or full duty.

III. Survey Supervisor's Responsibilities --

1. New Employee Orientation --

a. Give employee a copy of the Manual of Safe Surveying
Practices and allow him time to read and study it. Be available to
answer any questions. Make certain the employee understands the
spirit of the Manual and its basic requirements, especially that of
"being responsible for his own safety and the safety of others".

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b. Tell the employee that first aid in the field is available from a qualified party member.

c. Driver's Training --

(1) Within 90 days of employment, schedule the employee for Defensive Driver Training.

(2) Secure for the employee the official Driver's Permit.

d. Describe hazards the employee will probably encounter in his first assignments and protective measures he must take.

e. Explain the safety responsibilities of --

(1) The employee's supervisors.

(2) The employee.

f. Brief the employee on --

(1) Medical care available through his employment.

(2) Compensation benefits.

(3) The role of the District Mishap Prevention Program.

(4) The supervisory mishap investigation process and its purpose of preventing mishaps.

(5) Mishaps and injury reporting and their purposes.

(6) His right to refuse to perform tasks that are dangerous or hazardous to his well-being and health.

(7) His responsibilities in case of personal and motor vehicle mishaps.

2. Personnel and Job Assignments --

a. Keep a certified first aider on each survey party.

b. Assign trained and/or especially capable personnel to parties working on jobs that require hazardous tasks, such as --

(1) Chain saw use.

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(2) Scaling steep or slippery slopes.

(3) Driving on bad terrain or unimproved roads with conventional or with four-wheel-drive vehicles.

c. Keep highly allergic personnel away from jobs where poison oak, creosote bush, or other toxic vegetation or substances cannot be avoided.

d. For parties working in high snake-hazard areas, provide lists of places where antivenin can be administered professionally.

e. Before assigning a party to a new job, determine if unusual hazards might be met and of preventive measures to be taken. Brief the party chief accordingly.

f. Postpone surveys near slippery roads.

3. Safety Training --

a. Disseminate information to all personnel regarding

(1) Conclusions about how recent injuries or accidents should have been prevented.

(2) New safety equipment available.

(3) New techniques developed that aid in safe surveying.

b. Provide sample tailgate meeting topics and outlines to party chiefs.

c. Schedule "safety" as a topic on the agenda of each Party Chief Meeting. Review some items of the "Manual" at each meeting.

d. Every three years schedule all employees to attend the Defensive Driver Training Program.

e. As needed, see that party chiefs and other designated personnel are trained in the use of four-wheel-drive vehicles, chain saws, laser EDMs, etc.

4. Safety Monitoring --

a. Periodically appraise the safety performance of party chiefs. Include this in performance appraisals, and take corrective steps for any deficiencies.

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- b. See that adequate safety equipment is stocked.
- c. See that only safe supplies and equipment, such as gads and stakes, are issued. Correct any material that is unsafe.
- d. Review reports and corrective action for accidents and personal injuries.
- e. Immediately correct safety deficiencies that are seen on jobs.

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CHAPTER 2

OPERATIONAL SAFETY

I. Animal Hazards --

1. Assume that all animals are potentially dangerous.
2. Have owners secure hostile-acting animals before entering enclosures containing such animals.
3. Do not enter enclosure with high fences if an animal hazard is within.
4. Carry a pointed lath or a range pole to ward off an attacking animal. Retreat is usually advisable but do not turn your back and run unless you can reach safety before the animal reaches you.
5. Do not approach, attempt to capture or kill, or attempt to pet either domesticated or wild animals.
6. Be especially wary of sick-appearing animals, animals with young, stallions, bulls, and guard dogs. Do not handle dead or seemingly-dead animals, fowl, or reptiles.

II. Construction Operations --

1. Before Starting Work -- Determine potential hazards from natural environment, the public, and the contractor's operations. Plan accordingly.
2. During Work --
 - a. Be extremely cautious around heavy and fast-moving equipment, especially equipment with limited driver's visibility. Do not rely on the operator's visibility, judgment, or ability.
 - b. Suspend survey operations when uncontrollable hazards develop.
 - c. Resume work only when safe working conditions have been restored.
 - d. Display and use safety devices and gear as needed for maximum safety.

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e. Notify the resident engineer of any unsafe operations or conditions on the job.

f. Do not ride in or on contractor's construction equipment unless required by your job.

g. Do not walk girders or along edges of raised platforms without guard rails unless safety nets are in place or safety lines are used.

h. Do not work on or traverse any walkway, ramp, or other elevated structure over 6 feet tall that does not have adequate railings, cleats, or guards.

III. Cutting Tools, Hand --

1. Use the right type and size of tool for each cutting operation.

2. Keep all cutting tools sharp. Sharpen tools with a file that has a handle with a hand guard. Turn dull saws in for replacement.

3. When not in use, sheathe or store so cutting edges are not exposed. Store and carry machetes and tommy axes in the leather sheaths provided.

4. Do not use tools with splintered or loose handles.

5. Properly use each tool --

a. Machetes --

(1) Sharpen machete blades only from six inches from the butt of the handle to within two inches of the point.

(2) Use gloves and wrist straps, as required.

(3) Station machete users at no closer than 20-foot intervals. Protect yourself by retaining this minimum safety zone.

(4) While chopping, if possible, lean forward.

(5) Always chop away from the body.

(6) Swing with a full swing, but do not overswing or swing too hard.

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(7) Clear small vines, etc., before cutting larger vegetation.

(8) Right Handed --

(a) Right Foot Forward -- When swinging downward toward the left or when swinging upward to the right.

(b) Left Foot Forward -- When swinging downward toward the right or when swinging upward to the left.

(9) Left Handed -- Reverse the right-handed procedure.

(10) Do not use machetes for heavy cutting.

(11) Use long-handled lopping shears instead of machetes for cutting thorny bushes and briars.

b. Axes and Brush Hooks --

(1) Clear away any impeding, light growth with a machete or a hatchet before chopping.

(2) Allow ample space between adjacent choppers and keep other persons out of the area.

(3) Carry with the handle gripped behind the head and the cutting edge facing outward.

(4) Do not use double-bit axes.

(5) For extended, heavy brushing use a small chain saw instead.

IV. Digging Tools, Hand --

1. Picks --

a. Do not use a pick head that is either sharply pointed or badly blunted.

b. Make certain the head is "bound" tightly to a good handle before swinging.

c. Allow ample space for swinging.

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- d. Do not overswing on the backswing.
- e. Wear eye protection when digging in very hard material.
- f. As you swing, squat by flexing the knees so the pick handle will be horizontal when the point strikes the earth. (This will also keep the point away from your feet.)

2. Shovels --

- a. Use a round-pointed shovel for digging in hard earth.
- b. Do not use the shovel in the same manner as you use a digging bar. Place the blade of the shovel on the earth and force it into the earth with your foot.
- c. Keep one foot on the ground at all times.
- d. Discard a cracked shovel; dress one that has a blunted blade.
- e. Do not use the shovel as a pry bar.

3. Digging Bars --

- a. Work with the feet widespread.
- b. Hold the bar in close to the body and lift and drop it vertically.
- c. Keep the point sharp enough to do the job without having to lift the bar excessively high.
- d. Do not use a bar that is bent.

V. Driving Tools, Hand --

- 1. Use the right type and size of tool for each driving operation.
- 2. Check for defects before using.
- 3. Do not use hatchets, axes, and other wood cutting or driving tools for driving or hammering metal.

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4. Avoid striking brittle or mushroomed metal with a hammer because bits of steel may chip off causing serious flesh or eye injuries.

5. Use safety glasses when driving or cutting metals.

6. Do not use tools with splintered or loose handles or with mushroomed or cracked heads. This includes the driving tool and the implement being driven.

7. Allow ample space for the swinging required. When squatting use either a short-handled tool or keep the long handle from between your legs.

8. When swinging, have the handle horizontal when the face of the driving head contacts the object being driven. With long-handled sledges this requires flexing the knees to lower the body during the swing.

9. Do not full-swing to drive objects that are more than waist high.

10. Do not hold an object for someone to drive by full-swinging.

VI. Electrical Equipment --

1. See Gasoline-Powered Equipment under "Fire Prevention" in this section.

2. Only use portable, electric hand tools that are double-insulated or that have a grounding wire. Do not remove grounding wires or prongs.

3. Do not use any equipment that has cords with broken insulation or damaged plugs or sockets.

4. Do not use electrical equipment when you or the equipment are standing in water or on saturated soil.

VII. Fence Crossing --

1. Use gates, when possible, and avoid crossings.

2. Use portable chain link fence climber steps or a trestle ladder.

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3. Do not attempt to carry anything when climbing an obstacle.
4. Cross barbed wire fences at the center of a span and have a "buddy" hold the wire(s) for you.
5. When stepping over a barbed wire fence lay a piece of heavy canvas, such as an empty materials bag, over the top strand.

VIII. Fire Hazard Areas -- See "Fire Prevention" and "Fire Control" in this section.

IX. Heat Illnesses -- Heat exhaustion, heat stroke, and heat cramps can result from the summer heat in most work areas of the District.

1. Preventive Measures --

a. Employee --

(1) Wear a light-colored head covering (a hard hat when required) that allows free air-circulation.

(2) Wear light-colored, loose-fitting clothing that minimizes skin exposure.

(3) Drink enough fluids.

(4) Replenish salt lost by perspiration, but do not overdo it.

b. Party Chief --

(1) Provide a constant, readily available supply of potable water.

(2) See that employees wear proper attire.

c. Survey Supervisor -- When heat is extreme and the survey requires considerable exertion, schedule work for cooler times of the day.

2. Diagnosis --

<u>Symptoms</u>	<u>Cramps</u>	<u>Exhaustion</u>	<u>Stroke</u>
Dizziness			perhaps
Cramps, severe	X		
Headache		perhaps	X
Nausea		perhaps	perhaps
Perspiration, profuse	X	X*	
Pulse, rapid			X
Skin, dry			X
Skin, pale and clammy		X	
Temperature, high			X
Tired		X	
Uncon- sciousness		rare	often*
Vomiting		perhaps	perhaps
Weakness, extreme*		X	

* = In severe cases

X = Symptom present

3. Treatment -- Refer to the Red Cross first aid manual for specific first aid measures and for more detailed symptoms. If aid is required and you do not have the Red Cross manual, treat the symptoms:

- a. Protect the patient by shading or taking indoors.
- b. Lay the patient down and make him rest.
- c. Replenish lost body fluids by giving, if conscious and able to drink, a half teaspoon of salt in a half-glass of water, as tolerated. Repeat at 15-minute intervals for three or four doses. (Usually for "exhaustion" or "stroke".)
- d. Cool extreme temperature by unclothing and freely sponging patient with lukewarm water or alcohol. Lower to 103°F and maintain at least that low. (A pulse rate of 110 per minute is generally indicative of a safe temperature.)

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e. Do not give stimulants.

f. Massage or apply firm pressure to cramping muscles. Warm moist heat often helps.

g. Seek medical aid if either "exhaustion" or "stroke" are indicated.

X. Insect Bites and Stings -- Some persons are highly allergic to the stings and bites of insects. More people in this country die from bee stings than from snake bites. If an allergic employee is stung or bitten --

1. Apply a "Sting-Swab" from the first aid kit.

2. Apply cold packs to minimize swelling, then --

3. Immediately take the victim to a medical facility for treatment.

Treat spider bites of either the Black Widow (hourglass) or the Brown Recluse (fiddle) spiders the same as snake bites. However, do not attempt venom removal. Obtain prompt medical treatment.

XI. Lasers -- All laser EDM operators must be certified. Other Survey personnel must be aware of these precautions.

1. Do not look directly into a laser beam at close range.

2. Do not look directly into a laser beam at any working range with binoculars or telescopes. (The intensity of the beam is magnified by the square of the power of the optical instrument used.)

3. Do not allow prolonged exposure of the eye at any working range.

4. Do not operate laser equipment unless you are a certified operator or unless you are a trainee working under the direction of a certified operator.

XII. Lifting --

1. Properly lift only what you, or you and others, can safely handle. Do not be misled by bulk or lack of it. When you have any doubt about lifting, seek help or use a mechanical lifter.

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2. Beware of splinters, sharp protrusions, spiders, snakes, stinging insects and other such hazards.

3. Plan how the lifting, moving, and setting down of the object are to be done before beginning to lift.

4. If stooping is required, crouch as close to the load as possible.

5. Firmly grasp the object, keeping the spine straight, and lift the object--pulling it in toward the pelvic area.

6. Reverse this process when setting things down.

7. Always lift or lower objects with the leg muscles instead of with back muscles.

XIII. Mountainous Terrain --

1. Safety Lines --

a. Use issued safety lines and belts whenever injury could result from work on precipitous slopes or slippery rocks. Use 3-strand, 3/4-inch manila line or equivalent line that has a work-load rating of 1080 pounds and a breaking strength of 5400 pounds. This provides a safety factor of 6 for a 180-pound person.

b. Use knots that will not slip.

c. Be sure the line is anchored securely.

d. Wear a hard hat and eye protection when safety lines are required.

Note: If sheer slopes must be traversed by personnel, these employees should have a basic knowledge of mountain climbing techniques.

2. Traversing Hazardous Areas --

a. Test footing and locate the safest route before proceeding.

b. Avoid risky short cuts.

c. Do not run or leap down hill.

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d. Use the "buddy" system in isolated areas.

3. Rattlesnake Areas --

a. In remote mountain areas and all snake-infested areas the party must have a snake bite kit and first aid supplies. During survey planning determine the nearest medical facility where antivenin is available.

b. Each member who is isolated from the rest of the party must carry a snakebite kit.

c. Include chemical cold packs in the supplies.

d. See Snake Bite in this topic.

4. Stream Water -- Do not drink stream water or water from any untested source.

XIV. Night Operations -- Hazards become more potent and are harder to neutralize at night. Therefore --

1. Survey Planning --

a. Even more so at night, make safety the number one priority.

b. Allot extra time for all operations.

c. Make certain you have enough person power, equipment, and supplies.

2. Party Orientation -- Prepare all party members by proper briefing and issuance of adequate equipment.

3. Mountainous Areas --

a. Always use the "buddy system".

b. To guide personnel, use reflective material to flag safe roads and trails into work areas and to specific points.

c. Provide radio communication for each work area.

d. Double your precautions against --

(1) Snake bite in warm weather.

(2) Fires in dry seasons.

4. In Traffic --

a. Include public safety in survey planning.

b. If traffic promises to be particularly hazardous, seek assistance from the District Office, Resident Office, or from law enforcement agencies.

c. Have all personnel wear white coveralls and reflective garments or devices when working in traffic at night.

d. See Traffic, Working in in this topic and the topic "Traffic Control" in this section.,

5. Public Relations -- When night surveys will probably disrupt traffic or might arouse the curiosity of local residents, notify local law enforcement agencies and the Highway Patrol. Consider giving advance public notice through local news media.

Note: This should be done through the Survey office.

XV. Poisoning, Brush -- Medical authorities agree that avoidance is the best prevention for poison oak (*rhus diversiloba*) dermatitis. But rhus-sensitive people can react from contact with implements and clothing that others have used in poison oak brush. Much can be done to help in the fight against the "Oak".

1. Preventive Measures --

a. Keep highly-allergic employees away from poison oak in all seasons of the year. Dermatitis can result from barren bushes, or vines, as well as from fully-leafed plants.

b. Adopt a survey plan which minimizes exposure.

c. Be able to recognize the plant and thereby better able to avoid it.

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WESTERN POISON OAK



WHERE IT GROWS:

All along the Pacific Coast, from Southern California into Canada.

HOW IT GROWS:

Most often as an upright shrub, with several woody stems growing from the ground. In open fields it can grow into large spreading clumps—sometimes six feet tall! In forests it becomes a vine and grows upward for 25 and 30 feet!

THE LEAVES:

Always grow in groups of three leaflets.

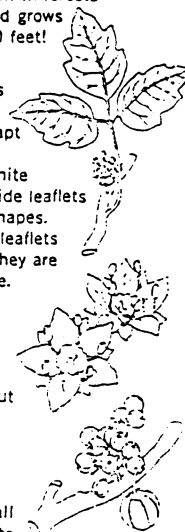
The center leaflet is apt to be similar on both sides and have a definite "oak-leaf" look. The side leaflets often take irregular shapes. Sometimes all of the leaflets have smooth edges. They are glossy and leather-like.

THE FLOWERS:

They grow and are shaped much like common poison ivy flowers—they are about $\frac{1}{4}$ " in diameter, greenish white.

THE FRUIT:

Creamy or greenish white, the size of small currants. The segments are clearly defined with lines.



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d. Encourage immune employees to substitute for allergic employees whenever intermittent exposure occurs on a given project or task.

e. Wear long sleeves and gloves to minimize contact with the plant. Close cuffs and collars by taping.

f. (1) Wash body immediately after exposure. If exposure is continuous, stop every two hours, or more often, and wash. If rubbing alcohol is available, apply to the washed areas. Rinse with clear water.

(2) Wash clothes five or six times with laundry soap and tepid water. Rinse thoroughly after washing.

g. Change clothes and wash boots each day after exposure. Use a strongly alkaline laundry soap, such as Fels Naptha, for cleaning work apparel. (Dry cleaning is the one safe method for highly sensitive persons.)

h. Clean "contaminated" tools with the commercial cleaning fluid perchlorethylene or very strong laundry soap. Only use cleaning fluid out-of-doors. Wear neoprene or other waterproof gloves with either cleaning agent.

2. Treatment --

When every precaution is still not enough and dermatitis develops --

a. Use medications which are made specifically for poison oak dermatitis.

b. If the severity of the dermatitis warrants or if it persists, see a doctor who is approved for treatment of industrial injuries.

Poison oak is not the only plant which triggers dermatitis. In desert areas avoid contacting grease wood (or Creosote Bush) and Encilia. Some persons are allergic to these plants, and the reaction is similar to that caused by poison oak. Precaution and treatment are the same as for poison oak.

XVI. Power Lines -- Regard all power lines as dangerous.

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1. Contact -- Avoid actual contact with or possible arcing to any equipment from electrical lines. In damp conditions double your precautions. EM 385-1-1 establishes minimum clearances between equipment or persons and high voltage lines. These clearances range from 10 feet at 50 kv or under to 35 feet at 500 kv.

2. Taping -- Do not tape across canyons and terrain where a tape might possibly be pulled up into or lowered atop a power line. Use an EDM or a form of indirect measurement instead of taping.

3. Power Line Elevations--Do not make a "direct" measurement of the height of a power line, even with a fiberglass rod.

XVII. Power Tools -- Power tool usage requires maximum alertness and adequate training.

1. Training -- Employees must be given proper instruction before being allowed to operate such equipment as chain saws. Do not operate a power tool unless you have been trained in its use. To legally operate a Ramset, you must possess an operator's card.

2. Operator and Co-Worker Protection -- Eye and hearing protection shall be used when chain saws, jack hammers, and Ramsets are operated. Such protection must also be used by helpers. Nearby co-workers must use eye protection. They also must use ear protection if the noise levels specified in Sec 32, EM 385-1-1 are exceeded.

XVIII. Pressurized Spray Cans -- Serious injuries and costly cleanup have resulted from improper handling of pressurized spray cans.

1. Do not puncture or incinerate.
2. Store at temperatures lower than 120°F.
3. Do not carry in vehicular passenger compartments.
4. Dispose of through local refuse disposal systems.

XIX. Radio Transmitters -- Mobile radio transmissions can set off explosive charges. If you are near blasting operations always check with the blasting supervisor before transmitting any messages.

XX. Railroads, Work Near -- Guidelines used when working within an "operating right-of-way" are for the safety of the surveyor and the railroad. These general rules are --

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1. Always be alert for any type of railroad equipment. They are not always heard- especially if there is other noise, if a railroad car or locomotive is coasting, or if a train is moving slowly. When necessary, station a party member as lookout.

2. Never crawl under stopped cars, and do not cross tracks between cars. They may be bumped at any time. (The engineer and the brakemen work only one side of the train.)

3. Avoid any use of the color red. To a trainman, red means "immediate danger" and "STOP", without exception. Surveyors MUST NOT wear red vests or clothing when working near rails; instead, wear yellow or international orange. Red markers, flagging, or lights shall not be used for any reason. Do not use fuses on highways at grade crossings unless unmovable, injured persons or disabled vehicles are on the tracks or you have found a condition that could derail the train.

4. Do not leave protruding stakes or any holes within 10 feet of the centerline of the tracks.

5. Do not park vehicles within 10 feet of the tracks; train crews need this area for their operations.

6. When taping across railroad tracks, support steel tapes above the rails at all times. Steel tapes contacting both rails at once might activate signals. In switching areas, steel tapes can activate signals even when laid parallel to the rails. Therefore, only let nonmetallic tapes touch the ground.

7. Do not leave instruments or other equipment unattended, on or near tracks.

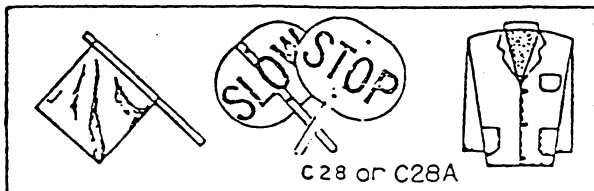
XXI. Sights, Survey -- Do not leave red heads, concrete filled sight cans, or other similar sights where they might damage vehicles or be hazardous to pedestrians. All sights or points of any kind, both permanent and temporary, shall be guarded in a manner which protects the public as well as the survey point.

XXII. Signalling, Hand --

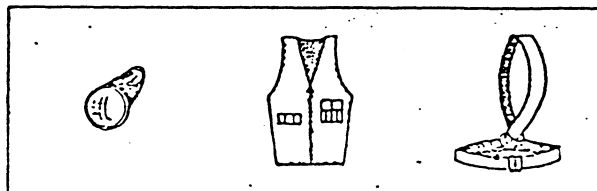
1. Do not use red flagging or red targets for signalling when working in or near traffic. Such signalling might confuse motorists. (See Fig. 1-04-G.)

SAFETY

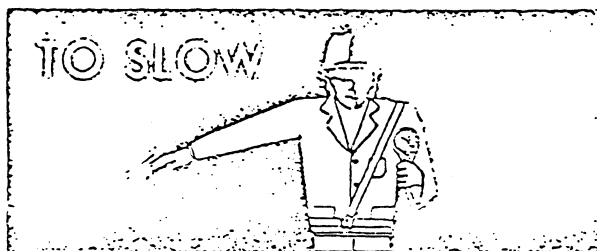
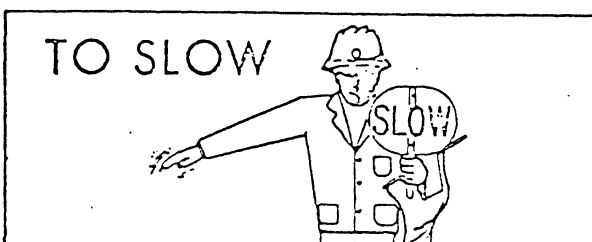
DAYLIGHT



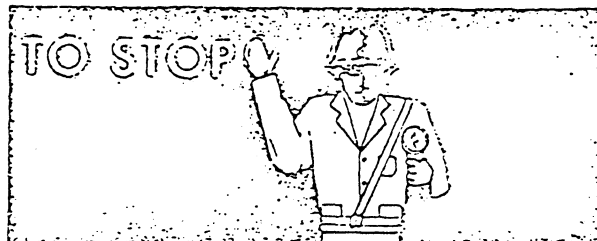
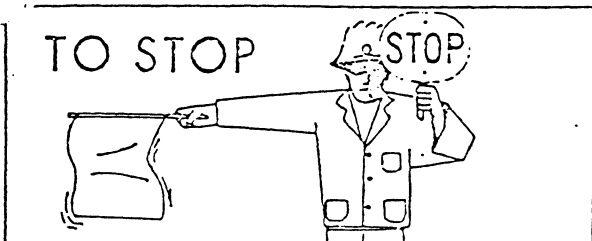
NIGHT



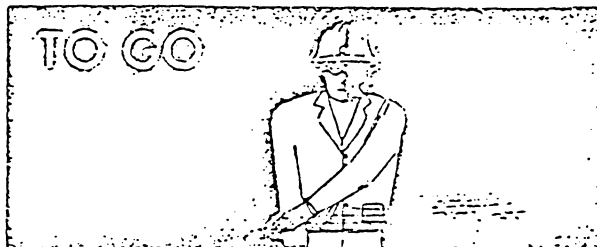
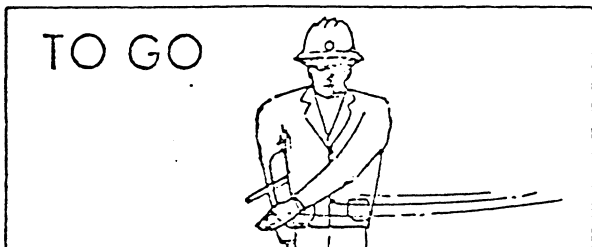
You must use the flag, paddle, colored garment, hard hat. You must use a red light, approved garment, and a reflectorized belt. NEVER USE A FLAG OR PADDLE TO WAVE TRAFFIC.



Place flag under left arm, hold "slow" paddle in left hand close to body; with right hand extended, palm down, make a pressing down motion. Hold flashlight in left hand in vertical position, extend right hand (palm down) and make a pressing down motion.



Hold flag straight out. "Stop" paddle should be high enough so red garment will not be in back. Hold right hand up; place flashlight in left hand in vertical position, close to body.



Drop flag by side and place paddle under right arm. Signal with a deliberate left hand motion across your body. Hold flashlight in right hand by side and make clear and deliberate motion across the body with left hand.

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2. Be wary of using the standard surveying hand signals if they might confuse motorists.

XXIII. Snake Bite -- Snake bites of surveyors are quite rare. Yet, the hazard of rattlesnakes abounds throughout California. Even if preventive measures fail, current knowledge and treatment offer the best prognosis for snake bite victims.

1. Precautions -- Though seemingly rare, poisonous snakes annually bite 6,500 to 7,000 Americans. Include these precautions in your prevention program.

a. Always assume snakes are active (even though they are not usually active below 40°F.

b. Do not make "solo" trips across snake country which is remote from habitations and frequently used roads. Use the "buddy system" on such jobs.

c. When traversing brushy or grassy terrain, use a "decoy" such as a level rod or a lath, alongside your legs. Walk heavily to create vibrations that can be felt by snakes. (A snake does not hear.)

d. Walk away from the shaded side of clumps and bushes when the weather is hot and sunny.

e. Step atop logs and large rocks, instead of stepping over them and into unseen areas. The safest policy is to walk around such obstacles.

f. Do not jump down from overhangs onto areas where snakes might be hidden from view.

g. Avoid steep climbs where a snake, uphill from you, could strike the upper portions of your body. Bites on the torso, the neck, and the head are much more damaging and more difficult to treat than those on the limbs.

h. Never climb vertical, or near vertical, faces where handholds on unseen areas above your head are required.

i. Do not attempt, under any circumstances, to capture snakes.

j. Do not try to kill a snake unless its presence, in that place, is or might be a positive threat to safety. (In a snake's natural environment ecological balance depends on its existence.)

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k. Avoid likely snake areas such as small rodent trails or pack rats nests.

l. When necessary to move low-lying logs, large rocks, and boards, use a pry bar, not your hands.

m. Double your precautions at night.

n. Keep vehicles near your work area for rapid transport if snake bite should occur.

o. Have a snake bite kit and a chemical cold pack with each isolated employee.

p. Know the location of the nearest medical facility where antivenin is available.

q. Do not collect rattles. A fine and highly abrasive dust often accumulates inside the rattles and can cause lasting damage to the eyes.

r. Wear high leather boots or snake leggings in high-hazard areas.

s. Remember that rattlers do not always signal their presence by rattling.

2. Treatment -- Venom is not always injected when a poisonous snake bites. Indications that a victim has been envenomated are -- immediate, severe pain, swelling, and discoloration. Look for these symptoms before beginning any attempts at venom removal (Step 6). Always follow Steps 1 through 5.

a. Do not attempt to kill the snake. Rattlers are the only poisonous snakes in California. The fang marks (usually two but sometimes one if the bite is a "near miss"), the rattles (if not previously lost), and the snake's markings and coloration are sufficient identification.

b. Curtail all possible movement by the victim (physical activity is quite detrimental), and reassure him to relax him and slow his circulation. Keep the bitten area below the level of the heart if the bite is on a limb.

c. To restrict circulation, immediately apply a flat constricting band (belt, kerchief, etc.) two to three inches above the wound and above any swelling (between the bite and the heart). It

should be loose enough so you can insert a finger beneath it, without force. If it is any tighter than this, it can cut off circulation. Leave the band in place. Loosen only if swelling makes the band too tight. Do not use a boot lace or a narrow string as a constricting band. Do not attempt to use a tourniquet if the bite is on the face.

d. Apply antiseptic, then cold packs, either ice wrapped in cloth or chemical cold packs (do not tightly bind to the skin). Once a cold pack is applied leave it on up to an hour or until medical aid is reached. Do not reapply, remove, apply and remove: this causes a "pumping" of blood in the area instead of restricting circulation. If a cold pack must be removed, do so gradually to prevent a rapid venom dispersal from the bite area.

e. If possible, carry the victim to a vehicle. Then drive him to a medical facility where antivenin is available for injection by qualified medical personnel. Have a pre-planned route to the facility. ACTIVITY RESTRICTION, CONSTRICTION, COLD PACK, AND ANTIVENIN INJECTION should be the first and primary considerations for snake bite treatment. Up to 98 percent of the venom can be kept at the site of the wound for a full hour if the patient is kept calm and immobile and if a cold pack and a constricting band are properly applied and left in place.

f. Avoid incision and venom removal, if possible. But, if cold packs are not available and if location, lack of transportation, place of the snake bite on the body, and condition of the patient indicate a need for on-the-spot venom removal, then do not delay incision and venom removal.

(1) Sterilize the fang wounds and a scalpel or a sharp knife.

(2) Make one straight SUPERFICIAL incision that connects both fang marks and extend the cut 1/4-inch beyond each puncture; deepen the cut thru skin and fat but NOT into muscle, tendons, or nerves. Cutting might be easier and safer if the skin is pinched up. Do not make cross incisions, and cut most carefully.

Note: If the incision is crosswise to veins, tendons, and muscles, make sure the cut is superficial only.

(3) Squeeze venom gently from the incision with the fingers for 20 to 30 minutes (or for the time it takes to reach medical aid); do not use suction with the mouth. The human mouth is far from being aseptic and infection could easily result.

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XXIV. Subsurface Work --

1. General --

a. Use ladders for places and situations that are difficult to enter or reach.

b. On sloping concrete slabs and hard earth slopes, be cautious of slipping on loose sand and grit.

c. Be just as cautious on wet and slimy, concrete channel bottoms.

d. Beware of rattlesnakes and spiders in manholes, trenches, sewers, and drains.

e. Have an outside observer in constant touch while subsurface work is in progress.

f. Even though all other precautions are taken, use a lifeline whenever cave-ins or asphyxiation are at all possible.

2. Open Excavations --

a. Unless it is adequately shored or properly sloped, do not enter or work in a trench that is deeper than 5 feet. On contracts ask the construction inspector if the shoring is adequate.

b. Trenches less than 5 feet deep must not be entered if ground movement appears possible.

c. Use this same criteria when a workman must stand near the edge of trenches.

d. Do not park vehicles near the edge of excavations.

XXV. Towers, Surveying -- The term "tower" refers to both an inner tower which supports a piece of surveying equipment over a survey mark and an outer tower which supports personnel as they use or maintain the equipment on the inner tower. In this topic the primary emphasis is on the outer, personnel-bearing, tower.

1. General Guidelines -- Erection and use of surveying towers shall follow the guidelines given by the tower manufacturers and EM 385-1-1, Sec 22.

2. Tower Design --

a. Homemade --

(1) Height Limit -- 25 feet.

(2) Design Adequacy -- In addition to the guidelines in EM 385-1-1, Sec 22, the design of any homemade tower, ramps, runways, platforms, scaffolds and towers over 15 feet tall shall be approved by a registered Civil Engineer.

b. Readymade -- Any readymade tower shall be equal to or better than the "Bilby" tower in structural soundness, stability, and other safety features.

c. Railings -- In accordance with the EM 385-1-1, para 22.A18, a personnel platform that is 6' or higher shall have a safety railing. In addition, any lower-height tower shall have a safety railing if personnel safety so dictates per paragraph 22.A19, EM 385-1-1.

3. Tower Erection -- "None but workmen skilled in the erection of scaffolds or falsework and their helpers shall be so employed, and the work shall be under the supervision of a person with proper experience and attitude for securing a safe installation".

Generally, Survey personnel will not be used for erection of towers over 25 feet high. Taller towers should be erected by adequately trained personnel or by erecting contractors.

4. Tower Use --

a. Stay off towers if you are afraid of heights or if a tower is unstable.

b. Provide and use ladders in conformance with EM 385-1-1, Sec 22.

c. Stay off tower members -- climb only on ladders provided.

d. Always keep both hands and arms and both feet and legs free for climbing.

e. Do not carry heavy, bulky, or cumbersome loads on your back.

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- f. Test handholds, footing, and tower or ladder steps on each step, up or down.
- g. Climb cautiously, without haste.
- h. Keep at least one hand and one foot on solid support at all times.
- i. Make sure the platform has railings, if required.
- j. Leave before an approaching storm reaches a tower.
- k. Stay off towers during wind, rain, sleet, snow, and electrical storms.
- l. Do not climb a tower that is covered with ice, snow, or any other matter that will make climbing and occupation hazardous.

XXVI. Traffic, Working in -- (Also, see the topic "Traffic Control", below, in this section.)

1. Face Traffic -- When working on the traveled way of divided roads or on the shoulders of highways, face traffic at all times or be guarded by a coworker. When working in a narrow zone between two-way traffic, stand parallel to the traveled way and have a buddy guard you.

2. Move Deliberately -- Do not make sudden movements that might confuse a motorist and cause him to take evasive action or panic, stop, and cause an accident.

3. Signal Cautiously -- Cautiously use surveying hand signals so they will not be mistaken for a flagman's direction to motorists. Use radios if available.

4. Use Required Control Devices -- (See "Traffic Control," in this Section.)

5. Avoid Interrupting Traffic Flow --

- a. Work as much as possible from offset lines.
- b. Minimize crossing any traffic lanes. On highspeed, heavily-loaded highways do not try to walk or run across traffic lanes. On freeways with wide shoulders and medians, drive across.
- c. When possible work one side of a roadbed at a time. (See Item 4, below.)

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d. When Cross Sectioning -- Keep a rodman on each side of the roadbed.

6. Whenever Possible, Place a Vehicle Between Traffic and Workers.

7. See "Night Operations" in This Section.

XXVII. Water, Drinking --

1. Containers used to carry drinking water shall be kept clean and filled only with fresh water. (Cases of hepatitis have been traced to dirty and improperly maintained water containers.)

2. Use disposable drinking cups.

3. If ice is added to the water, it shall be transported to the water can in a sanitary wrapping or container.

XXVIII. Water Operations -- When surveyors are exposed to the hazard of drowning, they shall be supplied either Coast Guard approved life jackets or belts, or ring buoys with life lines, or life lines, or any combination of the three. Life lines must be equal to or stronger than 3/4 inch diameter manila. Manila or nylon are preferred because they remain flexible even when wet. Avoid the use of single-fibered lines.

1. In Boats --

a. Wear a life jacket or a life belt at all times.

b. Use only safe boats.

c. Follow the common rules of boating safety.

d. Only use boat operators that have been trained in boating safety.

e. Work with a "buddy."

2. In the Water --

a. Do not wade barefoot. Wear rubber boots to protect against cuts, cold, and water.

b. Work with a buddy.

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c. Wear a life jacket or belt at all times.

d. In Still Waters --

(1) Limit wading to waist-deep locations. Wear chest waders.

(2) Probe with a pole for holes and soft ground before proceeding.

e. In Moving Waters --

(1) Do not wade if --

(a) The water is more than mid-thigh high.

(b) The product of stream velocity in f.p.s. and stream depth in feet equals ten or more.

(c) Footing is difficult to retain because of any or a combination of -- stream velocity, stream bed roughness, or slipperiness, unless, a tautly stretched life line is used as a hand rail.

(d) Doubt exists as to safety.

f. Along Shore Lines, Trenches, and Fills --

(1) Ocean Shores --

(a) Wear rubber boots if you are working only along the edge of the surf.

(b) Schedule work at low tides.

(c) Do not work in the surf unless you are adept at ocean shore swimming and have on a life jacket or belt.

(d) Do not work in a heavy surf.

(2) Inland Shores -- Wear rubber or leather boots for snake protection.

(3) Do not walk on floating debris in reservoirs or debris basins.

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(4) Be cautious of recently puddled trenches and dredging fills.

g. Work Over Water -- See EM 385-1-1, Sec 07, E, 07F, 07G.

CHAPTER 3

VEHICLES

I. In addition to this text see "Personal Safety Responsibilities" in this section.

The key to safe driving is "defensive driving." Some accidents which have involved Government vehicles were legally the other party's fault. However, some of these accidents could have been prevented if the driver had driven defensively.

II. Seat Belts -- Use of seat belts is mandatory for drivers and passengers in Government-owned vehicles and private vehicles used on Government business.

III. Accident Prevention -- The majority of vehicular accidents are of three types. They are--backing, colliding with the vehicle ahead, and being struck from the rear.

1. Backing Accidents -- These accidents can be prevented by a few preventive measures:

- a. Park, when possible, so backing is not necessary.
- b. Never back up without first checking to the rear. Dismount and personally check, if in doubt.
- c. Check mirrors for maximum visibility.
- d. On trucks use fish-eye mirrors.
- e. When visibility is limited, use a second person to provide guidance.
- f. Unless parking parallel, do not back while in a traffic lane.
- g. Do not back into a traffic lane unless adequate visual checks are made.

2. Rear End Collisions -- Prevent rear end collisions by --

- a. Following at a safe distance.
- b. In inclement weather, increasing the following distance to allow for changes in conditions.

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- c. Observing conditions as far ahead as possible.
 - d. While driving, constantly checking for clear areas for evasive action.
 - e. Paying attention to traffic and flow and staying alert.
 - f. Watching the mirrors, especially when stopping, slowing, or moving slowly.
3. Locked Wheel Skids -- Avoid locked wheel skids in panic stops. When rear wheels lock, traction on those wheels is diminished to the point that fish tailing often results. When front wheels lock, steering control is lost.

To avoid locked-wheel skids on slippery roads, rapidly pump the brakes. Press and release them quickly, once or twice a second. This gives alternate intervals of braking and steering control.

4. Speed -- Adjust your speed to the weather. Posted speed limits are for ideal conditions only. Slow down in rain, snow, or patchy fog. In heavy fog, park completely off the road and turn off your lights. Otherwise, another driver may think you are still on the road and hit you from the rear.

5. Alertness -- Do not drive unless you are physically and emotionally able to drive safely. All other driving hazards are compounded if you are not at your physical and mental best. Alcohol, fatigue, and illness slow reflexes. Some medicines impair driving performance. So-called stay-awake drugs can cause you to sleep with your eyes open.

IV. Basic Safety Rules of Operation -- In addition to the guidelines in Accident Prevention, in this topic, some basic rules to be used while operating or riding in a vehicle are --

- 1. Never let job urgency transcend safety.
- 2. Use defensive driving techniques at all times.
- 3. Allow for the limited visibility, acceleration, braking, and the large size of survey wagons.
- 4. Check on the safety of the vehicles before operating them, and do not knowingly operate a vehicle that is unsafe.

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5. Use seat belts and require that passengers use them before the vehicle is underway.

6. Do not drink any alcoholic beverages prior to or during vehicular usage. Also, do not drive if you are taking medications or drugs that can impair physical or mental faculties.

7. Do not attempt to drive when any abilities are impaired.

8. Do not stand in or on any part of a vehicle while it is in motion. Passengers must be seated with their seat belt fastened.

9. Always park vehicles in a safe manner and in a safe place. Avoid parking too close to the path of construction equipment or behind standing equipment. When possible, park so backing is not required.

10. Never back without first checking the area to the rear.

11. Check overhead clearances when in doubt or if tolerances are close.

12. Keep all tools and equipment securely fastened in their designated places. See that this is done before moving a vehicle.

13. Obey all traffic laws, signs, speed limits, and signals.

14. Keep all vehicle doors closed except when entering or leaving the vehicle.

15. Keep all survey truck cabinets closed when not in actual use.

16. Do not overload vehicles, especially survey trucks, with personnel, equipment, or supplies.

17. Never exceed the intended capabilities of a vehicle. For example, do not use a survey truck in terrain where a four-wheel-drive vehicle is required.

18. Have a rear view mirror in the cab of all survey wagons so passengers can be seen as they enter and leave.

19. Do not use a haul road when fast-moving dirt movers are operating on the road.

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20. Flammables, caustics, and acids --

- a. Carry only when required.
- b. Do not carry in passenger compartments.
- c. Carry flammables in Type I or Type II safety cans. (Low volatile paint thinner may be kept in tightly-capped one-quart steel cans.)
- d. Use NiCad batteries for powering EDMs.
- e. If wet-cell storage batteries must be used, carry them in tilt-proof and splash-proof boxes. Secure this container in the vehicle so it cannot shift or slide.

21. Weekly, check the lug nuts on survey wagons.

22. At all times obey the Vehicle Manual.

23. Before and after using a vehicle, report in writing to the GSA Motor pool, tire defects and unusual wear and any mechanical problems that might have developed.

24. Verify the safety of each vehicle before operating it. This includes, but should not be limited to --

- a. Visually checking tires for inflation and adequate thread.
- b. Checking all illuminating, directional, and warning lights, as well as gauge lights.
- c. Windshield wiper operation and condition of blades.
- d. Brakes and steering.
- e. Mirrors.
- f. Horn.
- g. Door and hood latches, windows, seatbelts, etc.
- h. Trunk or other storage for jack, lug-wrench, reflector flares, tire chains where issued, safety flares, spare tire, first aid kit, and fire extinguisher, if required. A 5-pound, dry-chemical Type A-B-C extinguisher shall be carried on each survey wagon. A 5-pound

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A-B-C extinguisher must be carried on other vehicles used to transport flammables or if the vehicle, itself, might start a fire at an off-road worksite.

25. Do not have more than three persons in the front seat of a vehicle.

26. Except in emergencies do not push a vehicle with another vehicle.

V. "Jumping" Dead Batteries -- This should not be done except in extreme emergencies and only with caution, to avoid possible "blow-up" of battery.

CHAPTER 4

FIRE PREVENTION

I. Regulations and Public Relations --

1. Obtain all required permits and strictly heed all provisions.
2. Daily, tell the agency having control of the land and the local fire-fighting agency where you will be working.

II. Survey Planning -- Plan an escape route, and an alternate, from the site of each operation.

III. Gasoline-Powered Equipment --

1. Equip chain saws, generators, jack hammers, and motor vehicles with approved mufflers and spark arrestors.
2. Park motor vehicles so --
 - a. Fire roads are not blocked.
 - b. Gasoline does not leak from filler necks.
 - c. Hot engine or exhaust system parts do not contact flammable vegetation.
3. Inspect the undercarriage of motor vehicles to see that electric wires, exhaust systems, and fuel lines have not been ruptured by "high-centering" or by brush.
4. Store and carry gasoline in Type I or Type II safety cans. (This applies to flammable liquids stored anywhere.)
5. Fill gasoline tanks only in areas that are clear of combustibles.
6. Set portable generators so the exhausts are directed at areas which are clear of combustibles.
7. Keep at least one, two-pound, dry-chemical Type A-B-C fire extinguisher with each portable combustion engine or at any operation that might cause a fire. (A long-handled, round point shovel might also be of value.)

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8. Set hot engines only on non-combustible materials and away from possible contact with dry grasses and other tinder.

9. Do not leave a vehicle engine running while parked.

IV. Electrical Equipment --

1. Place batteries, dry cells, and wiring in cleared areas and on stable bases.

2. Anchor unattended electrified signals and sights so wind and animals cannot knock them over.

3. Do not use wires with frayed insulation or poor connectors.

V. Smoking -- Lighted tobacco is forbidden in hazardous areas.

VI. Equipment --

1. Shovel -- Have one or more long-handled, round pointed shovels available at the site of each survey operation.

2. Extinguisher -- One, two-pound type A-B-C extinguisher shall accompany each piece of gasoline-powered equipment.

3. Other -- Check with the controlling agency to learn if additional equipment is required.

VII. Action --

1. Extinguish the fire, if possible, and do not let your escape route become blocked.

2. If you cannot contain or extinguish a fire --

a. Warn others nearby. Use the local frequency on your radio to warn others on your party and to warn other parties.

b. Follow your planned escape procedures.

c. Notify the proper fire-fighting agency. (If a Sacramento District frequency radio is available, call a base station.)

3. Be wary of a fire which is anywhere near your work area. If it might be a possible threat to you, go to a safe place until the threat has passed.

CHAPTER 5

FIRST AID AND SUPPLIES

I. Kits --

1. Individual --

a. Distribution -- Provide one kit for each employee who is isolated from the primary survey vehicle and fellow employees.

b. Contents -- The individual kits should be packaged in airtight, metal or plastic boxes or unit packages which will fit in canvas belt pouches.

c. Location -- Store in the primary survey vehicle for use as required.

2. Survey Party --

a. Distribution -- Provide one kit for each survey party.

b. Contents -- The kit shall contain a minimum of 16 unit packages. The container shall be dust and moisture proof. In addition to the 16 units, stock and store a pair of scissors and a pair of tweezers inside the container.

The only medicant allowed in the kit is antiseptic prepodyne swabs.

c. Supplementary Supplies -- These may include cold packs (either 30 or 60 square inches), absorbent cotton, and cotton-tipped applicators.

Note: The inclusion of cold packs is strongly recommended for the treatment of burns, sprains, stings, swelling, and snake bite.

d. Location -- Store in the vehicle that serves as the primary survey vehicle. In that vehicle, place the kit in a visible and accessible place.

II. Qualified First Aiders -- At least one employee in each office and on each party shall have successfully completed the Standard American Red Cross First Aid Course or MESA First Aid Course. All employees are encouraged to take the course.

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Stretchers and Splints -- Unless ambulance service and medical facilities are more than 30 minutes away, these items are not needed. The wire mesh or inflatable splints in the 16-unit kits are adequate for most injuries. Also, lath and flagging may be used to devise additional splints.

CHAPTER 6

TRAFFIC CONTROL

I. Purpose -- Temporary traffic control devices and methods are used to establish a "work area" for the protection of employees and the public.

II. When to Use -- Control measures shall be used whenever surveyors are working on any part of the roadway where vehicles normally travel or park or are likely to travel or park. Generally, this part of the roadway will be between hinge points or between curbs.

III. Planning -- Prior to placement of any control devices --

1. Try to devise a means of surveying while avoiding traffic. If this is not possible, then --

2. Study all possible factors that might dictate types, density, and placement of devices. Some factors to consider are --

- a. Prevailing speed.
- b. Peak traffic hours.
- c. Motorists' sight distance.
- d. Exact work site(s).
- e. Effect of unusual survey activities.
- f. Pavement conditions--wet, frosty, etc.

IV. Party Chief's Responsibilities -- The party chief must take all precautions necessary to control traffic so it safely passes through the work area. After an area of protection is established the party chief shall review the results. If traffic patterns change during the work period, he will again review control measures. If the established traffic control is not adequate, the party chief shall use enough additional controls to safely regulate traffic and provide a work environment where hazards are minimized.

In special cases the party chief might have to ask the Survey office to solicit help from--the District Safety Engineer or the Highway Patrol. The party chief must never allow survey operations to begin until an adequate area of protection has been established.

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V. Equipment -- Safety devices to use for temporary traffic control are --

1. Signs -- These include those supported on safety scopes, on vehicles, or on pipes inserted in guide marker posts. They also include the handheld "SLOW-STOP" paddles.

2. Red Warning Flags.

3. Traffic Cones.

4. Personal Safety Equipment

Use all required warning devices to assure maximum protection for personnel and the public and to minimize traffic interruptions.

VI. Placement of Devices -- Figures 1-04-A through F show typical placement and use of traffic control devices. However, placement and use will vary to meet local conditions. Figures 1-04-A and B show the use of a series of "pairs" of "SURVEY PARTY" signs for "control" on a freeway for a typical survey where lane or speed restrictions are not required.

To close a lane see Lane Closures in this topic.

1. Length of Work Area -- In general, limit the length of work area to 0.5 mile. When the scope of the survey is longer than 0.5 mile, if possible, finish all survey phases in an established area of protection before moving control devices and establishing a succeeding area. This reduces traffic control set-up activity which in itself can be hazardous.

2. Sign Types -- Each sign has a definite purpose and is to be used consistently and uniformly.

3. Longitudinal Placement -- If a flagman is used, refer to Figure 1-04-F and determine sign placement accordingly.

- a. Low Speeds -- If low speeds prevail in the approach to the site, place signs at 300-foot intervals in the immediate work area. Place them at even closer intervals in urban areas.

- b. Normal, Open Highway Speeds -- Place the first warning at least 750 feet ahead of the work area. If a series of signs is used, place the sign nearest the work site 500 feet in advance of the work area or the point of restriction. Space the rest of the signs in the series at 500-foot intervals (see Figures 1-04-A and B).

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c. High-Speed Facilities -- Increase the advance warning distance to 0.5 mile, or more.

d. On-Ramps and Cross-Roads--Where traffic enters the highway within a work area, add extra signs to notify entering motorists of the survey activity.

e. Method of Placement--Set out control devices in the same direction as the flow of traffic so you will establish protection as you go. When setting devices very near or on any part of the traveled way do so while afoot and with a "buddy" to protect you.

4. Lateral Placement -- The standard position for temporary signs is on the shoulder, far enough from the edge of pavement to easily clear traffic. (Portable sign standards shall be tied down or weighted to prevent toppling from wind. Securely fasten all leg weights.) When unusual conditions arise, positions may be varied for maximum effectiveness. Signs should be no more than 15 feet from the edge of traveled way.

5. Vertical Placement -- The bottom of a traffic control signal must be placed as high above the level of the adjacent traffic lane as it can be safely displayed on a portable standard.

6. Precautions in Placement --

a. Density -- Do not space signs any closer than the intervals shown in Item 3, above. Excessive signing is undesirable; it can cause confusion and, thereby, be self-defeating.

b. Lead Distance -- Signs placed too far in advance of the work area alert the driver too soon. If conditions, such as high speeds and topography dictate extra long lead distances, use supplemental signs to reinforce the warning. See Item 3, above.

c. After placement and before surveying begins, observe traffic to see if the devices are providing proper control.

d. Periodically check devices on extended surveys to see that all are still in place and have not blown over.

7. End of Work Area -- Signing is more believable to motorists if sign C32, "END SURVEY WORK", is placed at the end of each traffic control area.

8. Time of Placement -- All control devices and flagmen shall be placed before any survey operations are started.

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9. Shifting of the Area of Protection -- Signs and flagmen must be shifted as work progresses to maintain an adequate area of protection.

a. By Moving All Devices -- This method is best suited for conventional highways where U-turns can be made and access to both sides of the road is not difficult. All devices are moved in one continuous operation when work has progressed to the limit of the area of protection.

b. By "Opening" or "Closing" Signs -- This system can save much time where medians are non-traversable and where interchanges must be used for turning vehicles around.

(1) Opening Signs -- See Figure 1-04-A.

(a) Limit work and signing to one roadbed. The survey progresses in the direction of travel.

(b) Place pairs of fabric "SURVEY PARTY" signs to "straddle" the traveled way at 500-foot intervals, throughout the job length or through the day's expected progress (up to a maximum of 0.5 mile).

(c) Leave signs folded, or "closed", until the party reaches the next pair, which is then "opened".

(d) If a lane is closed, use a "shadow" truck to carry cones for placement as work progresses.

(2) Closing Signs--See Figure 1-04-B. The conditions of Item a, above, apply except--

(a) The Survey progresses opposite to the direction of travel.

(b) All the signs are initially "open", that is unfolded.

(c) Signs are closed as the survey progresses beyond them.

(d) Cones are removed as the survey progresses.

VII. Construction Projects -- Use warning devices as dictated by dust, visual obstructions, job traffic, other traffic factors, and if requested by the resident engineer or the contractor.

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VIII. Removal of Devices -- Also see Lane Closures in this topic.

1. Time to Remove -- Signs and other devices shall be removed immediately when protection is not needed. During prolonged work breaks, such as lunch periods, devices shall be removed, turned away, or their messages covered (fabric signs may be folded).

If signs are left up when workers are not visible, drivers tend to disregard all signing and consider it meaningless and unwarranted.

2. Method of Removal -- Pick up control devices in the direction opposite to traffic flow of the lane or roadbed where the devices are placed. This leaves protection for the removal operation.

IX. Nighttime Work -- Except for special surveys or because of "impossible" daytime conditions, surveys on or adjacent to roads shall be done only during daylight. When surveys must be done at night--all signs, cones, and barricades must be reflectorized or illuminated. Personnel must wear white coveralls and reflective accessories.

X. Peak-Hour Work -- On heavily traveled roads, schedule surveys only during off-peak hours.

XI. Lane Closures -- Today's surveying equipment and techniques generally make lane closures unnecessary. Use these guidelines if closures are considered.

1. When -- Use closures, ONLY after exhausting all alternatives. Partial closures (half-lane widths, etc.) shall not be made on multi-lane facilities.

2. By Whom -- On freeways, lane closures shall be made, if possible, only by Maintenance personnel or by contractors. Closures must be made at carefully regulated times and durations. (Some districts do not allow closures by survey parties.) Consult the District Safety Officer before arranging or making closures.

3. Sign and Cone Placement -- Typical sign and cone installation for lane closures are--

a. Conventional Highways and Streets--See Figure 1-04-C.

b. With Flagmen on Two-Way Highways and Streets--See Figure 1-04-D.

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c. Freeways--See Figure 1-04-E. On high speed roads, the safest placing of cones is by trained Maintenance personnel with their specialty equipment.

d. Cone Barriers--See Figure 1-04-E. Consider barriers on any road to warn motorists who might mistakenly "slip" into a closed lane.

4. Cone Spacing -- Spacing is dependent on prevailing speeds.

a. Under 25 MPH--A maximum of 25 feet.

b. Over 25 MPH--A maximum of 50 feet for taper lines and 100 feet on lane edges.

Space cones at 25-foot intervals at the immediate work location to round off the traffic channel and to clearly define the work area.

5. Shadow Trucks -- Use one or more protective vehicles between employees and oncoming traffic. A shadow truck should be kept close enough to employees to give physical protection, as if the truck were a barrier to the traffic. If available, use trucks with diagonal black and white stripes painted on the rear. If a driver remains in a shadow truck, he must be alert to the possibility of being tail-ended and having to support his head to prevent whiplash.

6. Cone Removal -- See Removal of Devices in this topic. Also--

a. High-speed roads -- Have project personnel (or the contractor) retrieve cones with their trained personnel and specialty equipment.

b. Lower Speed Roads--If you use a truck to retrieve cones, back the truck in the lane so the truck will not appear to be a "wrongway" vehicle.

c. When Survey Progresses Opposite to Traffic -- Retrieve cones as you progress beyond them so the length of the closure is gradually diminished.

XII. Flagmen --

1. When to Use--When operations are such that signs, signals, and barricades do not provide the necessary protection, on or adjacent to a highway or street, flagmen or other appropriate controls shall also be provided.

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A trained, alert flagman is one of the most reliable traffic controls. Flagmen can observe changing conditions and give exact instructions to motorists. A flagman also can act as an advance guard for a survey party by observing traffic and being prepared to relay warnings.

2. When Not to Use--A flagman's job is most hazardous and often monotonous. Therefore, use flagmen only when they are clearly needed. Flagmen are not to be used as substitutes for other required warning signs and devices. DO NOT USE an untrained flagman.

3. Equipment to Use --

a. Personal -- In addition to wearing proper day or night apparel, all flagmen must use a flag and a "SLOW-STOP" paddle during daylight and a red light at night. The preferred paddle sign is 24" in diameter and has a much longer handle than the 14"x11" elliptical C28. DO NOT USE a paddle sign to wave at traffic.

See Figures 1-04-F for apparel and equipment for flagmen.

b. Signs and Devices -- In addition to other traffic control devices and personal equipment for the flagman, a "FLAGMAN AHEAD" sign, must be used. See Figure 1-04-F and the paragraph Placement of Devices in this topic for placement guidelines.

4. Qualities --

a. Physical --

(1) A flagman must be highly visible to the public.

(2) Flagmen must be located enough in advance of the worksite that motorists will have ample time to reduce speed or stop, as required.

b. Personal --

(1) Trained -- All flagmen must be well versed in proper flagging techniques. Untrained personnel MUST NOT be used. Use Figures 1-04-F for training. Demonstrate all required flagging actions and have the trainee repeat each one several times. Stress that the hand and arm alone are to be used for motioning to motorists--flags and paddle signs shall NOT be used for motioning. Observe the trainee in action before leaving him on his own.

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(2) Alert--The flagman must be the most alert party member. He must not let his attention wander. Before a flagman begins to lose his attentiveness, replace him with a "fresh" flagman.

(3) Courteous--Flagmen must be courteous to all motorists, even those that want to argue and those who will not obey signs and devices. A flagman should be capable of favorably impressing the public and gaining its cooperation.

When a motorist refuses to obey instructions, record the vehicle's license plate number and the time of day. (Do not argue with the driver. Report the incident and its particulars to your immediate supervisor.) Often the visible act of recording the license plate number will cause a motorist to become cooperative. Diplomacy might be most necessary in this situation.

XIII. Individual Safety -- The safety of a surveyor often rests on that employee's own shoulders. Each employee must obey the basic rule of facing traffic at all times. If a surveyor cannot work facing traffic, the procedure should be changed or the order of work revised. If this cannot be done then the exposed employee should be provided a "buddy" who will serve as eyes for the vulnerable surveyor.

SAFETY

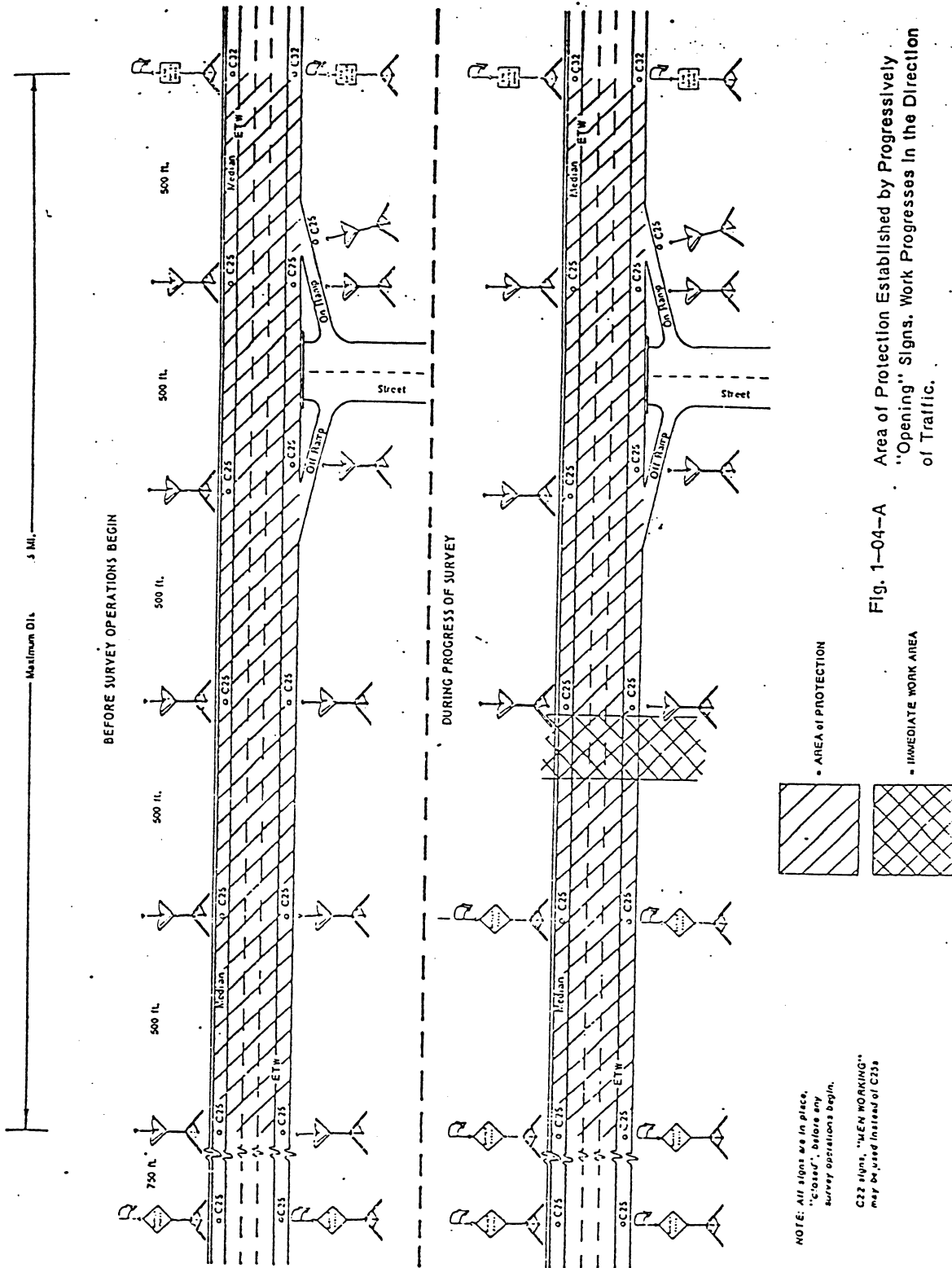


Fig. 1-04-A Area of Protection Established by Progressively "Opening" Signs. Work Progresses in the Direction of Traffic.

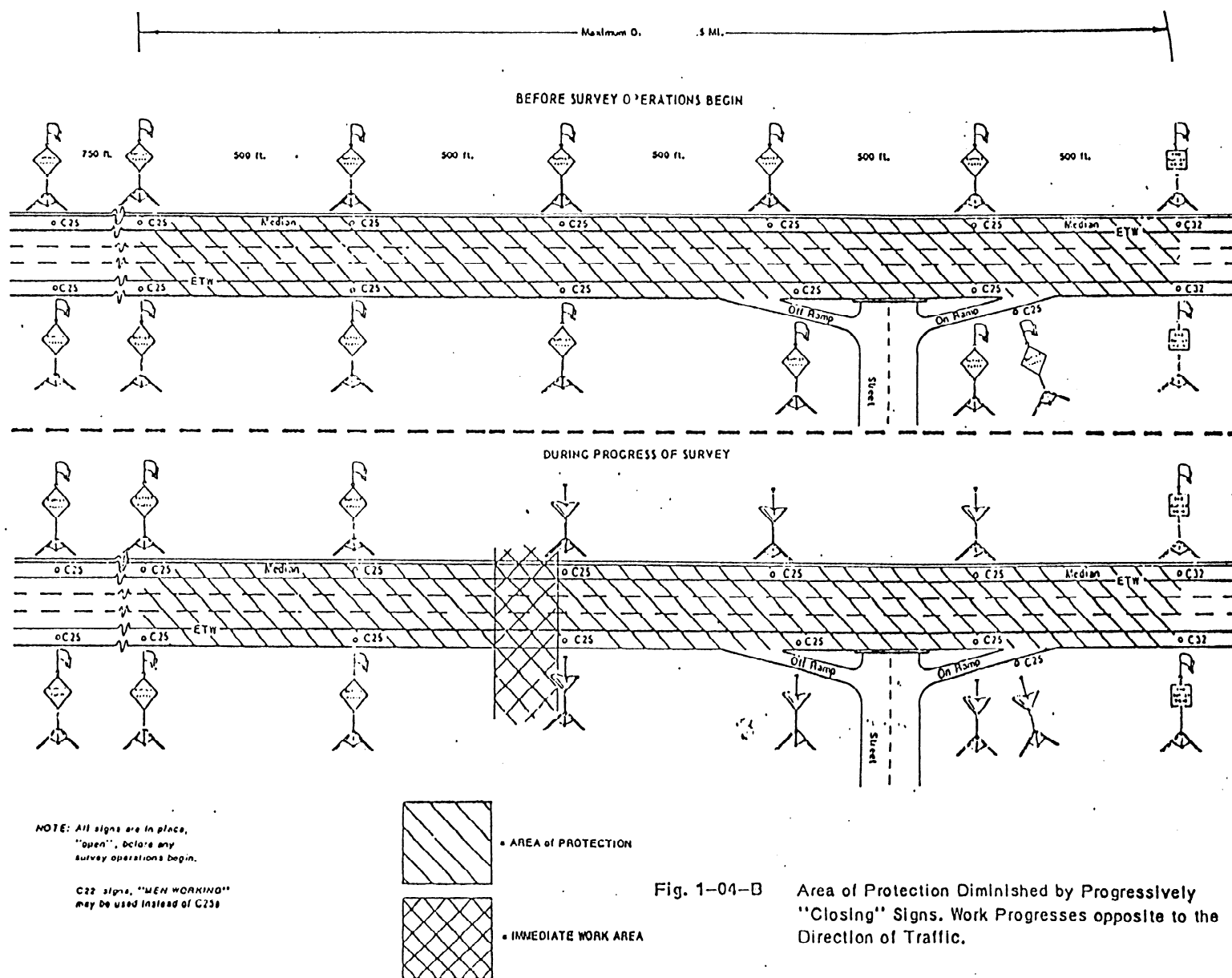


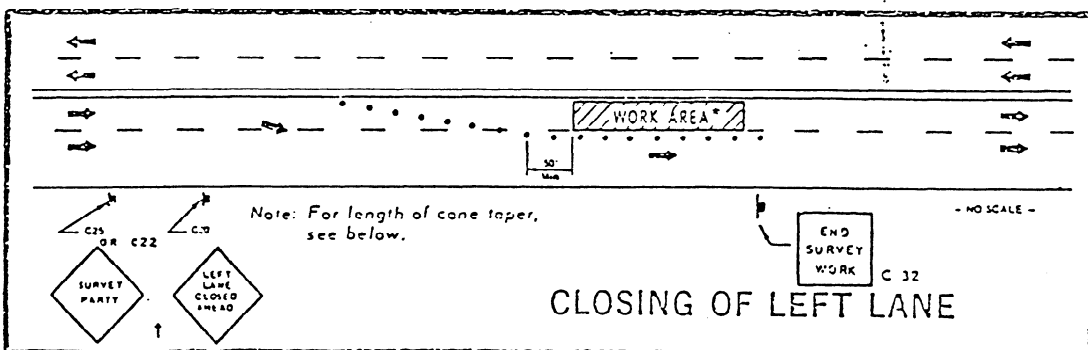
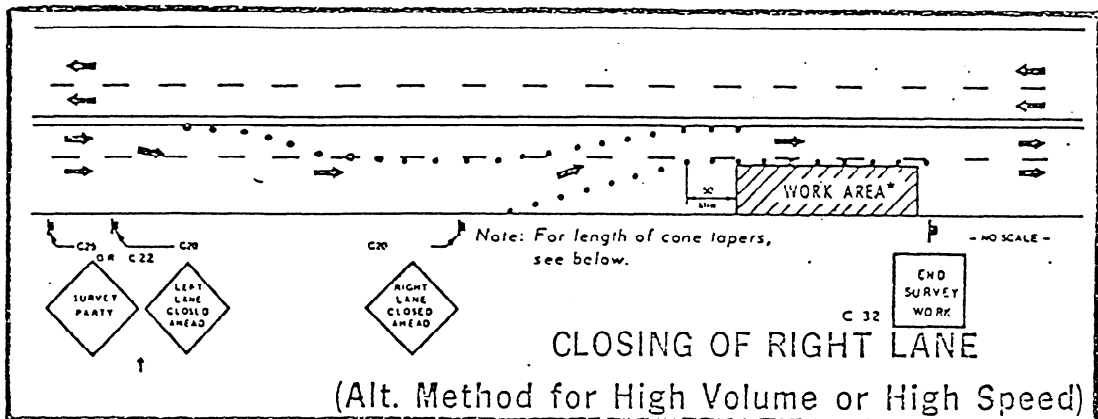
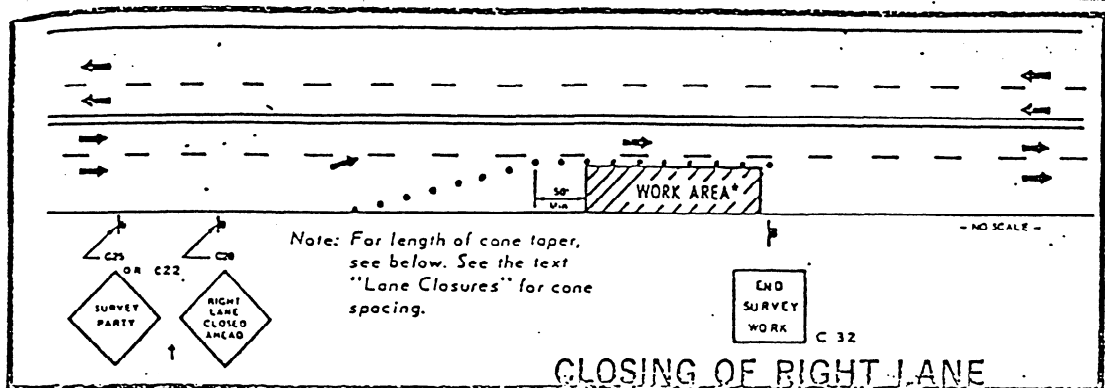
Fig. 1-04-B

Area of Protection Diminished by Progressively "Closing" Signs. Work Progresses opposite to the Direction of Traffic.

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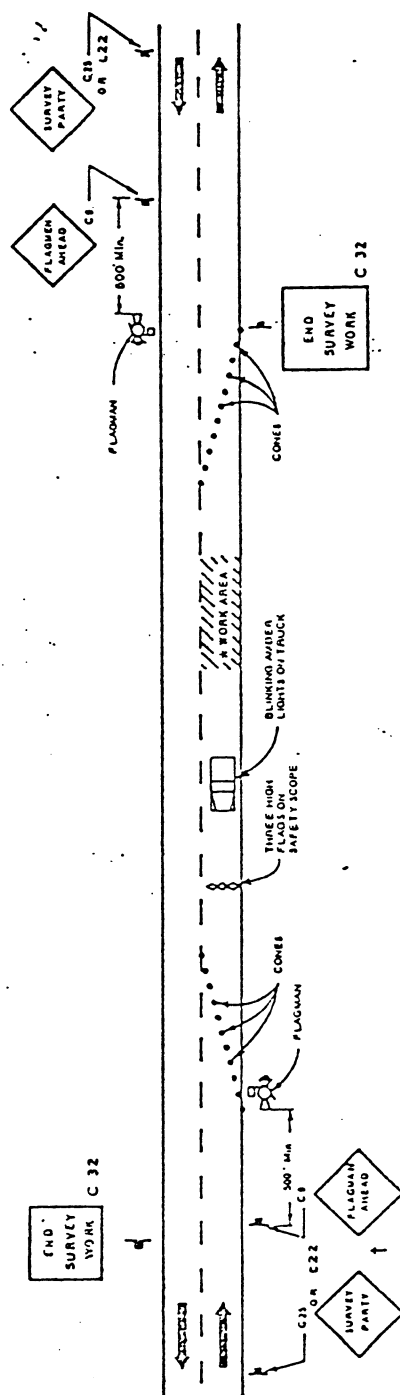
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NOTE	TRANSITION TAPER	LEGEND
DIVIDED ROADWAY - Supplemental advance warning signs shall be posted in the median (including painted medians). Signs are not required on opposite shoulder.	L T S & H L = Length of Taper S = Speed Limit H = Lateral Transition (usually lane width)	Sign (Shaded side faces traffic) Cones or Detectors Direction of Traffic

- † See text for longitudinal placing and spacing of signs.
• Limit work area to 0.5 mile.

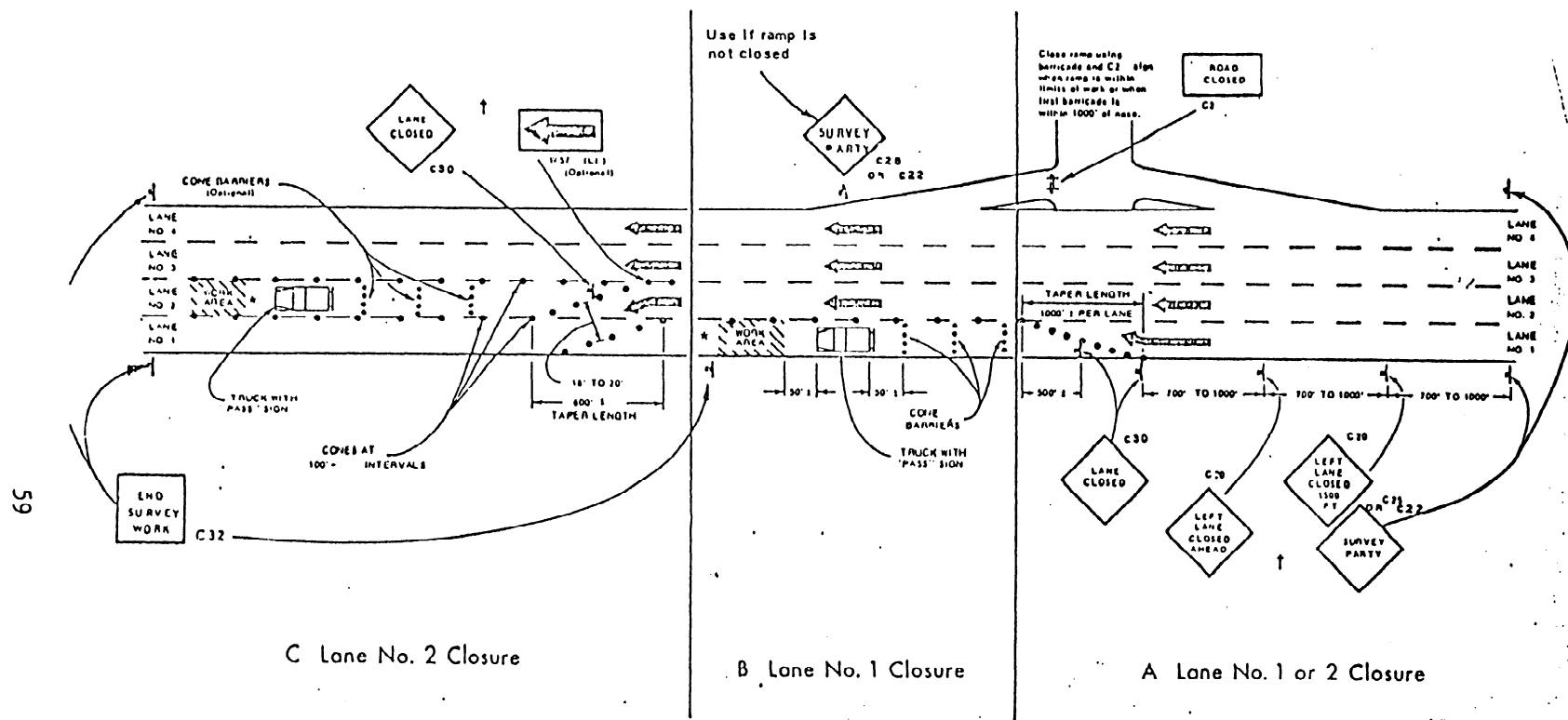
Fig. 1-04-C Lane Closures on Conventional Highways



Notes: See text, "Lane Closures", for cone spacing.
For length of tapers, see Figure 1-0.4-C.

† See text for longitudinal placing and spacing of signs.
• Limit work area to 0.5 mile.

Fig. 1—04—D Lane Closure, with Flagmen, on Two-Way Highway



- † See text for longitudinal placing and spacing of signs.
- Limit work area to 0.5 mile.
See text, "Lane Closures", for cone spacing.

INSTRUCTIONS:

CLOSING LANES

No. 1 Use A and B

- 2 Use A and C Connect Ingers with 350' of barlines or cones
- 3 Similar to A and C with Right replacing Left.
- 4 Similar to A and C with Right replacing Left.

NOTES:

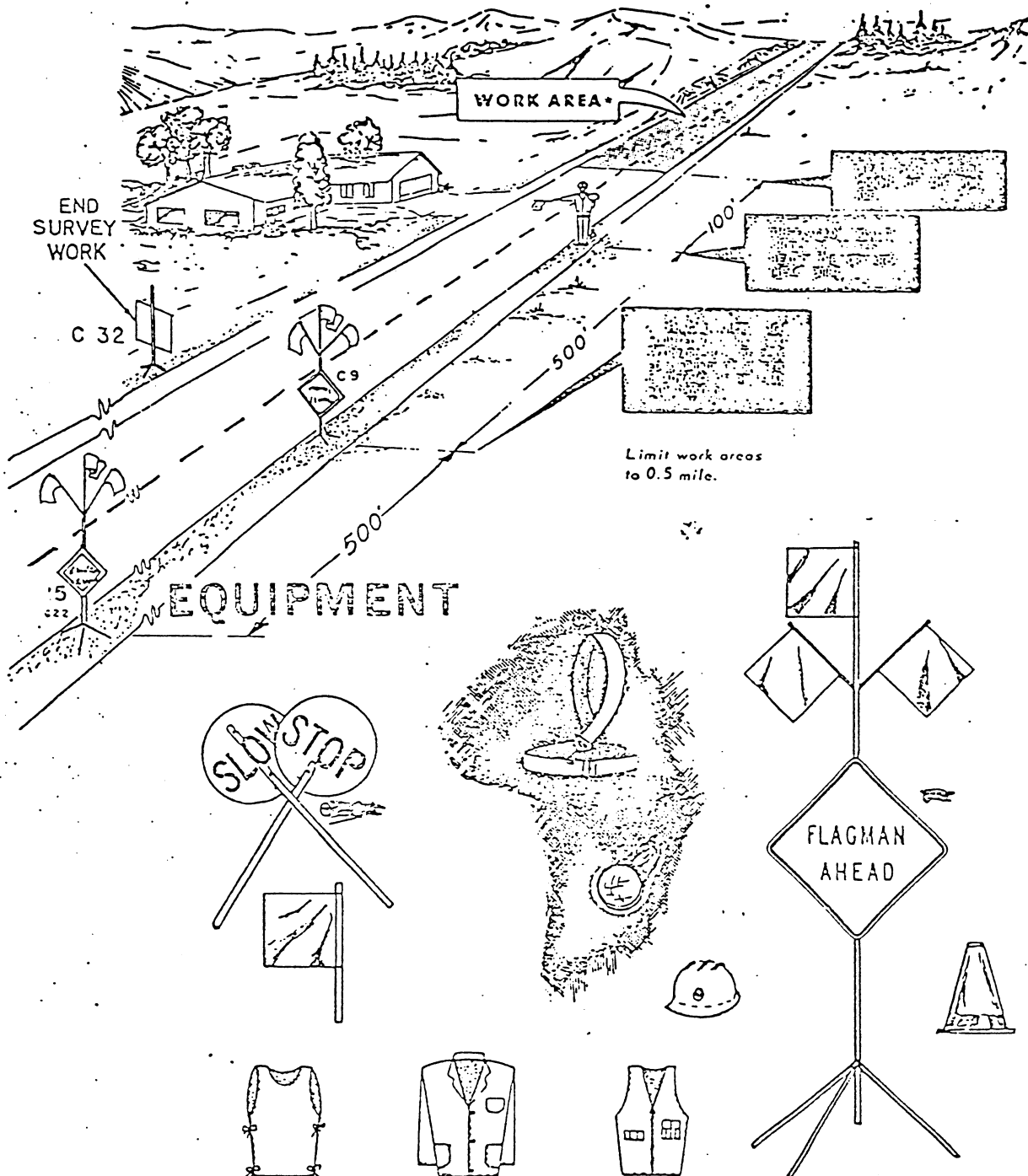
1. All signs to be removed or covered when lane is opened to traffic.
2. At intervals of 100' to 200' place cone barriers across closed lane. **(OPTIONAL)**
3. Signs to be placed from front to the rear and removed from rear to the front.
4. On Rural freeway, similar signing with minimum 300' exposure and one C 20 sign.

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Fig. 1-04-E Lane Closures on Freeways. (Signing shown for metropolitan freeways.)

SAFETY



All signs, flags, cones, and barriers must be removed when not actually needed for protecting the workmen.

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REFERENCES:

EM 385-1-1, General Safety Requirements Manual

"Surveying Safety Manual", Missouri Association of Registered Land
Surveyors and Univ. of Missouri, November 1973

"Caltrans Surveys Manual", 1-04-1, October 1975

"Recommended Safe Practices", California Council of Civil Engineers
and Land Surveyors, Sacramento, CA, 1975

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